REMARKS

Claims 1-30 are now pending in the application. Claims 1, 4, 5, 10, 11, 13, 16, 17, 19, 22, 24, and 29 are amended. New claims 31-38 are added.

The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

PROVISIONAL NON-STATUTORY DOUBLE PATENTING REJECTION

Claims 1-30 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-61 of copending Application No. 10/678,474.

Applicants expressly reserve the right to address this provisional double patenting rejection, as necessary, when conflicting claims are patented or at least indicated to contain allowable subject matter.

REJECTION UNDER 35 U.S.C. § 103

Claims 1-30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lotz (U.S. Pat. No. 4,856,735) in view of Grant (U.S. Pat. No. 2,772,058). This rejection is respectfully traversed.

At the outset, Applicants submit that the amendments to independent claims 1, 16, 22, and 29 have rendered moot the section 103 rejections of claim 1 (and claims 2-15 depending therefrom), claim 16 (and claims 17-21 depending therefrom), claim 22 (and claims 23-28 depending therefrom), and claim 29 (and claim 30 depending therefrom). Applicants further submit that the inventions set forth in claims 1-30 are patentably distinct over Lotz in view of Grant for at least the following reasons.

Independent claim 1 and 29 have each been amended to clarify that the airfoil or wing has a predetermined three-dimensional shape tailored to improve transonic performance over an un-slotted wing, and that the full-span transonic cruise slot has a predetermined three-dimensional shape to allow a portion of the air flowing along the lower surface of the leading airfoil element to diverge to flow over the upper surface of the trailing airfoil element and, thereby, to provide the performance improvement.

Independent claims 16 and 22 have each been amended to clarify that the full-span transonic cruise slot has a predetermined three-dimensional shape tailored to improve transonic performance over an un-slotted wing.

These features are not disclosed, taught or suggested by either Lotz or Grant, alone or in combination. Indeed, Lotz does not go beyond the two-dimensional aspects of an airfoil. For example, Lotz does not specifically address the three-dimensional shape of the slot or the airfoil.

Further, Lotz focuses on specifying general curvature levels in certain regions of an airfoil without regard to details about a three-dimensional airfoil/wing at a given flight condition. While Lotz appears to suggest locating the slot behind the shock, Lotz provides little to no rationale for the slot's positioning or shaping, which the inventors of the present application have realized can be relatively significant in order to achieve a performance gain. In this regard, various preferred implementations of the present invention utilize a full three-dimensional wing pressure distribution and address shock location and sweep by specifically tailoring the wing geometry so as to pull the shock back as close as possible to the slot location and controlling any subsequent re-expansions through shaping as well as positioning of the flap(s). As noted in the specification, preferred implementations included specific rules and guidelines that were developed for applying computational fluid dynamics (CFD) modeling to achieve these goals and allow airflows and their effects on an airfoil or wing to be mathematically predicted in a cost-effective manner.

Moreover, patent to Grant pertains to increasing airflow through a slot when a flap is deflected at takeoff or landing. But Grant's slot would be closed at normal cruise conditions, and thus is not a transonic cruise slot. In addition, the lower slot cover or deflector (that acts as a scoop) that is moved downwardly in order to increase airflow through the slot would generate significant drag. And if the deflector were deployed at cruise, the deflector would degrade (not improve) performance. Further, Grant does not provide any details about laying out the three-dimensional shape of the slot, wings, or flaps, for example, to control three-dimensional shock position and strength at cruise.

Because the cited references do not disclose, teach or suggest an airfoil/wing or a slot having a predetermined three-dimensional shape tailored to improve transonic

performance over an un-slotted wing, claims 1-30 are not rendered obvious by Lotz in view of Grant. For at least this reason, the Patent Office is respectfully requested to reconsider and withdraw the section 103 rejections of the claims 1-30.

With regard to dependent claims 2-15, 17-21, 23-28, and 30, these claims each depend from an independent claim shown above to be allowable. Accordingly, Applicants respectfully submit that claims 2-15, 17-21, 23-28, and 30 are allowable for at least the reasons given above in connection with the independent claim from which it depends.

In addition, the dependent claims are further patentably distinguishable over Lotz in view of Grant because these patents do not disclose, teach or suggest the additional features required by the dependent claims, such as:

> "the slot extends spanwise along the wing where airflow separation would occur to add drag during a transonic condition of the wing" (as recited in claim 5); or
>
> "the slot includes a plurality of segments longitudinally arranged along the wing, each of the segments being independently adjustable by the actuator structure to allow trimming of the slot differently at different locations along the span" (as recited in claim 11).

NEW CLAIMS 31-38

New claims 31-38 are each supported by the application as originally filed. Accordingly, no new matter is introduced by claims 31-38.

In addition, claims 31-33 each depend from independent claim 1 shown above to be allowable. Accordingly, Applicants respectfully submits that claims 31-33 are each in condition for allowance for at least the reasons given above in connection with claim 1. That is, none of the cited references disclose, teach or suggest an airfoil having a predetermined three-dimensional shape tailored to improve transonic performance over an un-slotted wing, and a full-span transonic cruise slot having a predetermined three-dimensional shape to allow a portion of the air flowing along the lower surface of the leading airfoil element to diverge to flow over the upper surface of the trailing airfoil element and, thereby, to provide the performance improvement.

In addition, claims 31-33 are further patentably distinguishable over the cited references in that the cited references do not disclose, teach or suggest the additional features required by claims:

> "slot location substantially coincides with shock location" (as recited in claims 31); or
>
> "the three-dimensional shape of the airfoil is tailored in accordance with three-dimensional airfoil pressure distribution data including information related to three-dimensional shock location and sweep of the airfoil" (as recited in claim 32); or
>
> "the airfoil has a pressure distribution corresponding to that shown in the figures" (as recited in claim 33).

Further, claims 34-38 are patentably distinguishable over the cited references in that the cited references do not disclose, teach or suggest a method that includes "tailoring a swept wing's three-dimensional geometry using three-dimensional wing pressure distribution data including information related to three-dimensional shock location such that the wing defines at least one full-span transonic cruise slot that allows a portion of the air flowing along a lower surface of the wing to diverge to flow over an upper surface of the wing during at least one transonic condition of the wing so as to achieve a performance improvement in the transonic condition".

As mentioned above, Lotz does not go beyond the two-dimensional aspects of airfoil design. Lotz does not specifically address three-dimensional wing pressure distribution or three-dimensional shock location. Lotz also does not address tailoring wing geometry and slot geometry in accordance with a wing's three-dimensional pressure distribution. Further, Lotz focuses on specifying general curvature levels in certain regions of an airfoil without regard to the detailed three-dimensional pressure distribution over a three-dimensional airfoil at a given flight condition. While Lotz appears to suggest locating the slot behind the shock, Lotz provides little to no rationale for the slot's positioning or shaping.

Moreover, the Grant patent pertains to increasing airflow through a slot when a flap is deflected at takeoff or landing. But Grant's slot would be closed at normal cruise

conditions, and thus is not a transonic cruise slot. In addition, the lower slot cover or deflector (that acts as a scoop) that is moved downwardly in order to increase airflow through the slot would generate significant drag. And if the deflector were deployed at cruise, the deflector would degrade (not improve) performance. Further, Grant does not provide any details about laying out the three-dimensional shape of the slot, wings, or flaps, for example, to control three-dimensional shock position and strength at cruise.

In addition, claims 35-38 are further patentably distinguishable over the cited references in that the cited references do not disclose, teach or suggest the additional features required by claims:

> "the tailoring includes locating the slot substantially coincident with shock location" (as recited in claim 35); or
>
> "obtaining the three-dimensional wing pressure distribution data by computational modeling" (as recited in claim 36); or
>
> "obtaining the three-dimensional wing pressure distribution data by simulating an airflow over the wing using three-dimensional computational fluid dynamics" (as recited in claim 37); or
>
> "the tailoring includes locating the slot where the three-dimensional computational fluid dynamics simulated airflow suggests that a pressure field will result in airflow separation on the upper surface of the wing" (as recited in claim 38).

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested.

Applicants believe that the appropriate fees are included herewith. The Patent Office is hereby authorized, however, to charge Deposit Account No. 08-0750 for any additional fees or to credit any overpayments thereto.

If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (314) 726-7502.

Respectfully submitted,

Dated: September 17, 2004

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